



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE  
HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of: Yoshiharo OHTA et al.

Application No.: 10/594,475

Examiner: Pegah Parvini

Filed: September 28, 2006

Docket No.: 2691-000058/US

SEMICONDUCTOR POLISHING COMPOUND

BRIEF ON APPEAL

Appeal from Group 1793

Date: April 13, 2010

Harness, Dickey & Pierce, PLC  
11730 Plaza America Drive, Suite 600  
Reston, VA 20190

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TABLE OF CONTENTS

I. REAL PARTY IN INTEREST.....	3
II. STATEMENT OF RELATED APPEALS AND INTERFERENCES.....	4
III. STATUS OF CLAIMS .....	5
IV. STATUS OF AMENDMENTS.....	6
V. SUMMARY OF CLAIMED SUBJECT MATTER .....	7
VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL .....	9
VII. ARGUMENTS .....	10
Principals of Law .....	10
A. Claim 1 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.....	11
a. Analysis of Pasqualoni.....	11
b. Analysis of Tamai.....	15
b.1 Combinability of References .....	16
c. Analysis of Yamada .....	16
c.1 Combinability of References.....	17
B. Claim 2 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.....	18
C. Claim 7 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.....	19
D. Claim 9 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.....	20
VIII. CONCLUSION.....	22
Appendix A.....	23
Appendix B.....	25
Appendix C .....	26

**I. REAL PARTY IN INTEREST**

The real party in interest for this appeal and the present application is NITTA HAAS INCORPORATED, by way of an Assignment recorded in the U.S. Patent and Trademark Office at Reel 018374, Frame 0252.

**II. STATEMENT OF RELATED APPEALS AND INTERFERENCES**

Co-pending application U.S. 10/594,635 is currently on appeal. There are no other prior or pending appeals, interferences, or judicial proceedings, known to Appellant, Appellant's representative, or the Assignee, that may be related to, or which will directly affect or be directly affected by or have a bearing upon the Board's decision in the pending Appeal.

**III.      STATUS OF CLAIMS**

Claims 1, 2, 7 and 9 are pending.

Claims 3-6, 8, 10 and 11 were cancelled during prosecution of the present application.

Claims 1, 2, 7 and 9 stand rejected.

Claims 1, 2, 7 and 9 are on appeal.

**IV.      STATUS OF AMENDMENTS**

An Office Action was issued on January 27, 2010, rejecting the pending claims submitted in an Amendment that was accompanied by a Request for Continued Examination on December 8, 2009. This Appeal Brief is submitted in response to the rejection issued on January 27, 2010.

**V. SUMMARY OF CLAIMED SUBJECT MATTER**

The subject matter of the present application relates to a semiconductor polishing compound used in polishing during the manufacture of semiconductors (page 1, lines 13-15). It is known that polishing compositions may include fumed silica or colloidal silica. However, silica slurries using fumed silica are known to have high agglomeration properties which results in difficulties maintaining dispersibility into a medium (page 4, lines 16-22). In an embodiment, of the subject matter of the present application, a semiconductor polishing composition polishes a semiconductor device with high accuracy and without polishing flaws while preventing the fumed silica from being agglomerated (page 9, lines 5-11).

Independent **claim 1** describes, a semiconductor polishing composition consisting of:

fumed silica as abrasive grains, the fumed silica having a bulk density of 50 g/L or more and less than 100 g/L (page 8, lines 14-18; page 24, line 5-page 28, line 9);

an acidic aqueous solution (page 18, line 15-page 19, line 7);

an alkali aqueous solution (page 20, lines 13-23); and

coarse particles of 0.5  $\mu\text{m}$  in diameter (page 10, line 20), the number of coarse particles being in a range of 66,595/0.5 ml to 112,453/0.5 ml (page 27, lines 5-15), wherein the alkali aqueous solution contains at least one additive selected from a group consisting of a polishing accelerator (page 11, line 15-page 12, line 13), an organic acid (page 13, lines 10-22), a complexing agent (page 14, lines 7-20), a corrosion inhibitor (page 15, lines 5-17) and a surfactant (page 16, lines 5-18), wherein an average particle diameter of the particles of the

fumed silica is in a range of 5 nm to 20 nm (page 10, lines 18-22) (also see generally page 26, line 20-page 28, line 9).

Dependent **claim 2** describes the semiconductor polishing composition of claim 1, wherein a content of the fumed silica is in a range of 10% by weight to 30% by weight based on a total amount of the composition (page 11, lines 4-9).

Dependent **claim 7** describes the semiconductor polishing composition of claim 1, wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide (page 8, lines 6-9; page 20, lines 13-23).

Dependent **claim 9** describes the semiconductor polishing composition of claim 2, wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide (page 20, lines 13-23).



**VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

The following grounds of rejection are presented for review:

Appellants seek the Board's review of the rejection of claims 1, 2, 7 and 9 under 35 U.S.C.

§103(a) as being unpatentable over U.S. Patent Application Publication 2004/015050 to

Pasqualoni et al. in view of U.S. Patent 6, 248,144 to Tamai in view of U.S. Patent

Application Publication 2004/0127047 to Yamada et al.

## VII. ARGUMENTS

Appellants request the Board reverse the Examiner's rejection of claims 1, 2, 7 and 9 which stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application Publication 2004/015050 to Pasqualoni et al. (Pasqualoni) in view of U.S. Patent 6, 248,144 to Tamai in view of U.S. Patent Application Publication 2004/0127047 to Yamada et al. (Yamada).

In support of the request, the following arguments are submitted.

### **Principals of Law**

Under 35 U.S.C. §103(a) a patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made (35 U.S.C. §103(a)).

The Examiner bears the initial burden of presenting a *prima facie* case of obviousness in rejecting claims under 35 U.S.C. §103. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). In rejecting claims under 35 U.S.C. §103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *In re Fine*, 837 F.2d 1071, 1073, 5 USPQ2d 1956, 1958 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), viz., (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; and (3) the level of ordinary skill in the art. "[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting

a *prima facie* case of unpatentability.” *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). Furthermore, “‘there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness’...[H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the would employ.” *KSR Int’l Co. v. Telefax Inc.*, 127 S.Ct. 1727, 1741, 82 USPQ2d 1385, 1396 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006)). However, “[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See Oetiker*, 977 F. 2d at 1445, 24 USPQ2d at 1444.

## Analysis

### A. Claim 1 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada

Claim 1 recites, in pertinent part, [A] semiconductor polishing composition consisting of fumed silica as abrasive grains, the fumed silica having a bulk density of 50 g/L or more and less than 100 g/L; an acidic aqueous solution; an alkali aqueous solution; and coarse particles of 0.5  $\mu\text{m}$  in diameter, the number of course particles being in a range of 66,595/0.5 ml to 112,453/0.5 ml.”

#### a. Analysis of Pasqualoni

Pasqualoni relates to a Chemical Mechanical Polishing (CMP) slurry composition used for polishing metals, that includes (a) a dispersion solution comprising an abrasive; and (b) an

oxidizer. The slurry composition has a large particle count of less than about 150,000 particles having a particle size greater than 0.5  $\mu\text{m}$  in 30  $\mu\text{L}$  of slurry, which is achieved by filtering the slurry composition prior to use (Abstract of Pasqualoni). The abrasive particles may be any material that is effective at removing metal and silicon layers. Silica is the abrasive material used in the present invention. The silica may be, for example, colloidal silica, fumed silica and other silica dispersions; however, the preferred silica is fumed silica (paragraph [0018]).

In rejecting the pending claims, it is alleged in the Office Action that Pasqualoni discloses “a large particle count of preferably about 25 to about 150,000 particles having a particle size greater than about 0.5  $\mu\text{m}$  in about 30  $\mu\text{L}$  (i.e., about 416 particles to 250,000 particles per 0.5 ml)” (see page 3 of the Office Action).

Appellants firstly traverse the allegation that Pasqualoni discloses “a large particle count about 25 to 150,000 particles” of fumed silica. Although the Abstract, paragraphs [0013], [0026], Table 2 and claim 1 of Pasqualoni disclose “a large particle count of less than about 150,000 particles” there is no support in the reference, nor is any support identified, for the allegation that Pasqualoni discloses “about 25 particles.”

Further, the allegation that Pasqualoni discloses a large particle count “to 250,000 particles per 0.5 ml” is incorrect. As discussed above, Pasqualoni discloses “less than about 150,000 particles having a particle size greater than 0.5  $\mu\text{m}$  in 30  $\mu\text{L}$  of slurry.” As pointed during prosecution of the present application, 150,000 particles/30  $\mu\text{L}$  equates to 2,500,000 particles/0.5 ml not particles to 250,000 particles/0.5 ml, as alleged in the Office Action rejecting the pending claims. Thus, Pasqualoni clearly discloses that the polishing composition includes course particles far in excess (i.e., more than 20x greater) of a range of 66,595/0.5 ml to 112,453/0.5 ml, as recited in the rejected claims.

Although Pasqualoni discloses that the number of large particles is “less than” 2,500,00/0.5ml, the disclosed range fails to render the rejected claims obvious because a prior art reference that does not disclose a specific embodiment in the claimed range does not correspond to the claimed range (see *Atofina v. Great Lakes Chemical Corp.*, 441 F.3d 991 (Fed. Cir. 2006)). Moreover, “the disclosure of a genus in the prior art is not necessarily a disclosure of every species that is a member of that genus” (Id 441 F.3d at 999). In the embodiments shown in Table 2 of Pasqualoni, slurries having fumed silica as an abrasive and particles of greater than 0.5  $\mu\text{m}$  in 30  $\mu\text{L}$ . However, none of the embodiments discloses a specific range that corresponds to, or is anywhere near, the claimed range. When the proper conversion is calculated Table 2 is as follows:

**Table 2**Results of test polishes

Test Conditions	# Particles > 0.5 $\mu\text{m}$ /30 $\mu\text{L}$	# Particles > 0.5 $\mu\text{m}$ /0.5 mL
Fumed Silica Slurry	150,000	2,500,000
Agitated K1020	737,000	12,283,000
Unagitated K1020	356,000	5,933,333
Unfiltered K1020	670,000	11,166,666
Filtered K1020	360,000	6,000,000
A5012 Ta	360,000	6,000,000

Also, if a reference’s disclosed range is so broad as to encompass a very large number of possible distinct compositions, a situation analogous to an obviousness of species when the prior

art broadly discloses a genus may be presented (*In re Harris*, 409 F.3d 1339, 74 USPQ2d 1951 (Fed. Cir. 2005); *In re Baird*, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994); *In re Jones*, 958 F.2d USPQ2d 1941 (Fed. Cir. 1992); MPEP §§2144.08, 2144.05).

In the present case the range disclosed by Pasqualoni (apparently 0-2,500,000 particles/0.5 ml) is so broad as to encompass many distinct compositions such that the range does not render the claimed range obvious.

Moreover, the claimed range is not obvious in light of the broad range disclosed in Pasqualoni due to the criticality of the claimed range recognized and described in the present application. As discussed throughout the specification of the present application, due to the elements of the claimed semiconductor polishing compound, the fumed silica is prevented from being agglomerated and therefore reduces and/or prevents polishing flaws in a semiconductor device due to the criticality of the maximum amount of coarse particles (see for example paragraphs [0017], [0025], [0083] demonstrating the criticality of the claimed range). As the maximum amount of coarse particles in Pasqualoni is many times greater than the critically recognized maximum of the present application, is not obvious.

Appellants also point out that in Pasqualoni, the “large particle count is intended to mean a count of particles where the particles have a particle size greater than about 0.5  $\mu\text{m}$ ” (emphasis added) (paragraph [0016]). In contrast, the rejected claims recite “coarse particles of 0.5  $\mu\text{m}$  in diameter.” Thus, it appears that the particles of large size in Pasqualoni are all in excess of 0.5  $\mu\text{m}$  in diameter and therefore Pasqualoni does not disclose the particles of the size as claimed.

Because Pasqualoni fails to disclose or suggest the all of the features as alleged in the Office Action, the rejection should be withdrawn and the application passed to issue.

**b. Analysis of Tamai**

It is alleged in the Office Action that Tami discloses the feature of independent claim 1 of “fumed silica as abrasive grains, the fumed silica having a bulk density of 50 g/L or more and less than 100 g/L” which claim feature is admitted as not being disclosed or suggested in Pasqualoni.

Tamai relates to a process for producing a polishing composition suitable for planarization in the production of semiconductor devices (column 1, lines 4-8). The process in Tamai includes using fumed silica having a bulk density of at least 70 grams per liter that is easily dispersed in water. Specifically, Tamai discloses that “in the process for producing a polishing composition of the present invention, the bulk density, namely the degree of clustering of primary particles, of fumed silica affects the step of dispersing the fumed silica and the quality of the resulting polishing composition. Because fumed silica having a bulk density of at least 70 g/L readily adjusts to water and smoothly disperses in water, such fumed silica readily crumbles and disintegrate readily. Though fumed silica with a bulk density larger than 120 g/L is not usually commercially available, such fumed silica is presumed to readily crumble and disintegrate to yield a good polishing composition. Because fumed silica having a bulk density smaller than 70 g/L hardly adjusts to water and does not disperse in water, such fumed silica hardly crumbles or disintegrates and can be an obstacle to a polishing composition with good dispersity and result in formation of scratches (column 4, lines 7-23 of Tamai). Thus, Tamai actually teaches away from that portion of the claimed range (50 g/L or more and less than 100 g/L) that is less than 70 g/L. Accordingly Tamai fails to disclose or suggest the claimed range as alleged in the Office Action.



**b.1 Combinability of References**

Further, due to the teaching away of a large portion of the claimed range, there is no motivation or suggestion for one of skill in the art to modify Pasqualoni to include the teachings of Tamai in an effort to achieve the claimed subject matter. For example, Tamai specifically states that fumed silica having a bulk density smaller than 70 g/L hardly adjusts to water and does not disperse in water, such fumed silica hardly crumbles or disintegrates and can be an obstacle to a polishing composition with good dispersity and result in formation of scratches.

Thus, there is no motivation or suggestion to modify Pasqualoni to include fumed silica having a bulk density of smaller than 70 g/L. Even were Pasqualoni modified as suggested in the Office Action, there would be no expectation of success of the resulting product because Tamai specifically teaches that a slurry using fumed silica having a bulk density of less than 70 g/L would result in the formation of scratches which is exactly what the subject matter of the present application seeks to avoid.

**c. Analysis of Yamada**

It is alleged in the Office Action that Yamada discloses the feature of claim 1 of “an average particle diameter of the particles of the fumed silica is in a range of 5 nm to 20 nm” which claim feature is admitted as not being disclosed or suggested in Pasqualoni.

Yamada relates to a polishing composition which is used in polishing the surface of a wafer for semiconductor devices and reduces haze that occurs on the surface of the wafer. The polishing composition includes silicon dioxide, an alkaline compound, a water-soluble polymer, and water. The silicon dioxide is colloidal silica or fumed silica, but preferably colloidal silica (paragraph [0010] of Yamada) and that the occurrence of scratches is “particularly suppressed”



when colloidal silica is used (paragraph [0028]). In Yamada, the average particle diameter of fumed silica is from 5 to 30 nm, and the average secondary particle diameter is from 5 to 200 nm (Abstract of Yamada).

### **c.1 Combinability of References**

It is alleged in the Office Action that one of skill in the art would have modified the CMP slurry composition of Pasqualoni to include the average particle size disclosed in Yamada because Yamada teaches that an average smaller size particle prevents an increase in an undesirable haze on the polished semiconductor.

Although Yamada may disclose a fumed silica having an average particle size is 5nm to 200nm, Yamada emphasizes that colloidal silica is preferable to fumed silica which teaching is contrary to the claimed subject matter which clearly emphasizes the preference of fumed silica as the abrasive compound in the slurry.

Additionally, as indicated in the Office Action, Pasqualoni is silent regarding the average particle size. Thus, it is unknown whether modifying Pasqualoni to include the average particle size taught by Yamada would have an adverse effect on the usefulness of the slurry of Pasqualoni or even if achieving the particle size of Yamada would be possible in the slurry of Pasqualoni. Therefore, it is unknown if somehow altering the average particle size of Pasqualoni to the particle size disclosed in Yamada would have been obvious to one of skill in the art at the time the present invention was made. Thus, it appears that the Examiner may be relying on the

improper use of hindsight analysis to combine the references without proper motivation or suggestion.<sup>1 2</sup>

Because the combination of references fails to disclose or suggest all of the features recited in the rejected claims, the claims are not obvious in light of the combination of applied art. Therefore, the rejection should be withdrawn and the application passed to allowance.

**B. Claim 2 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.**

Claim 2 recites “wherein a content of the fumed silica is in a range of 10% by weight to 30% by weight based on a total amount of the composition.”

In rejecting claim 2, it is alleged that Pasqualoni alone teaches a polishing composition comprising 10 weight percent of fumed silica. At paragraph [0018] of Pasqualoni the weight percent of silica is described as being in a concentration of about 4% to 10% and preferably about 5% to 9% of the total weight of the slurry and most preferably of about 6.5% to 8%.

Thus, although Pasqualoni a broad range of 4% to 10%, Pasqualoni fails to recognize the usefulness or criticality of concentrations at 10% or higher to maintain the aqueous dispersibility at a high level over a long term and still obtain a high polishing rate (see paragraph [0031] of the present specification).

Because Pasqualoni fails to disclose or suggest the claimed range of concentration of fumed silica, the combination of references fails to render the rejected claim obvious. A such withdrawal of the rejection and allowance of claim 2 is requested.

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<sup>1</sup> The teaching or suggestion to make the combination, and the reasonable expectation of success, must both be found in the prior art and not based on the Applicant’s disclosure (MPEP § 2143).

<sup>2</sup> See *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (“[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.”).

**C. Claim 7 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.**

Claim 7 recites “wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide.”

It is alleged in the Office Action that “[W]ith respect to the process limitations (i.e., mixing an alkali aqueous solution with an acidic acid solution, as is apparent from the claims, Pasqualoni et al. clearly teaches these, however, assuming arguendo, applicants use process limitations to define the product and “product-by-process” claims do not patentably distinguish the product even though made by a different process. In re Thorpe 227 USPQ 964.”

Appellants first traverse the allegation that claim recites “process limitations.” Rather, as noted above, claim 7 recites “wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide.” The content of the claimed polishing composition is not a process and the examination and rejection of the claim as a process is improper on its face.

Regarding the allegation that “product-by-process” claims do not patentably distinguish the product even though made by a different process, Appellants note that “the structure implied by the process steps should be considered when assessing the patentability of product-by-process claims on the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product.” *In re Garnero*, 412 Fed. 2d 276, 279, 162 USPQ 221, 223 (CCPA 1979); MPEP §2113.

Because *prima facie* obviousness has not been established, withdrawal of the rejection and allowance of claim 7 is requested.

**D. Claim 9 Is Not Rendered Obvious By Pasqualoni, Tamai and Yamada.**

Claim 9 recites “wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide.”

It is alleged in the Office Action that “[W]ith respect to the process limitations (i.e., mixing an alkali aqueous solution with an acidic acid solution, as is apparent from the claims, Pasqualoni et al. clearly teaches these, however, assuming arguendo, applicants use process limitations to define the product and “product-by-process” claims do not patentably distinguish the product even though made by a different process. In re Thorpe 227 USPQ 964.”

Appellants first traverse the allegation that claim recites “process limitations.” Rather, as noted above, claim 7 recites “wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide.” The content of the claimed polishing composition is not a process and the examination and rejection of the claim as a process is improper on its face.

Regarding the allegation that “product-by-process” claims do not patentably distinguish the product even though made by a different process, Appellants note that “the structure implied by the process steps should be considered when assessing the patentability of product-by-process claims on the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product.” *In re Garnero*, 412 Fed. 2d 276, 279, 162 USPQ 221, 223 (CCPA 1979); MPEP §2113.

Because *prima facie* obviousness has not been established, withdrawal of the rejection and allowance of claim 9 is requested.

**VIII. CONCLUSION**

For all of the reasons discussed above, it is respectfully submitted that the rejections are in error and that all rejected claims are in condition for allowance. For all of the above reasons, Appellants respectfully request this Honorable Board to reverse the rejection of the pending claims and direct that the application be allowed.

Respectfully submitted,

HARNESS, DICKEY & PIERCE, PLC

By: 

John W. Fitzpatrick, Reg. No. 41,018

P.O. Box 8910  
Reston, VA 20195  
(703) 668-8000

DJD/JWF:

**APPENDIX A – CLAIMS APPENDIX**

1. A semiconductor polishing composition consisting of:  
fumed silica as abrasive grains, the fumed silica having a bulk density of 50 g/L or more and less than 100 g/L;  
an acidic aqueous solution;  
an alkali aqueous solution; and  
coarse particles of 0.5  $\mu\text{m}$  in diameter, the number of coarse particles being in a range of 66,595/0.5 ml to 112,453/0.5 ml, wherein the alkali aqueous solution contains at least one additive selected from a group consisting of a polishing accelerator, an organic acid, a complexing agent, a corrosion inhibitor and a surfactant, wherein an average particle diameter of the particles of the fumed silica is in a range of 5 nm to 20 nm.
2. The semiconductor polishing composition of claim 1, wherein a content of the fumed silica is in a range of 10% by weight to 30% by weight based on a total amount of the composition.
- 3.-6. (Cancelled)
7. The semiconductor polishing composition of claim 1, wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide.

8. (Cancelled)

9. The semiconductor polishing composition of claim 2, wherein the alkali aqueous solution includes at least one hydroxide selected from ammonium hydroxide, alkali metal hydroxide, and alkaline earth metal hydroxide.

10.-11. (Cancelled)



**APPENDIX B – EVIDENCE APPENDIX**

None

**APPENDIX C – RELATED PROCEEDINGS APPENDIX**

A Notice of Appeal was filed in co-pending U.S. Patent Application 10/594,635 on February 12, 2010 appealing the final rejection of the claims in an Office Action mailed on August 10, 2009.

No Decision has been rendered in the proceeding.